

Assamoosick Swamp and Tributaries *E. coli* TMDL Development and Source Assessment

Assamoosick Swamp, German Swamp, Seacorrie
Swamp, Black Swamp, UT Assamoosick Swamp, UT
Seacorrie Swamp

First Public Meeting

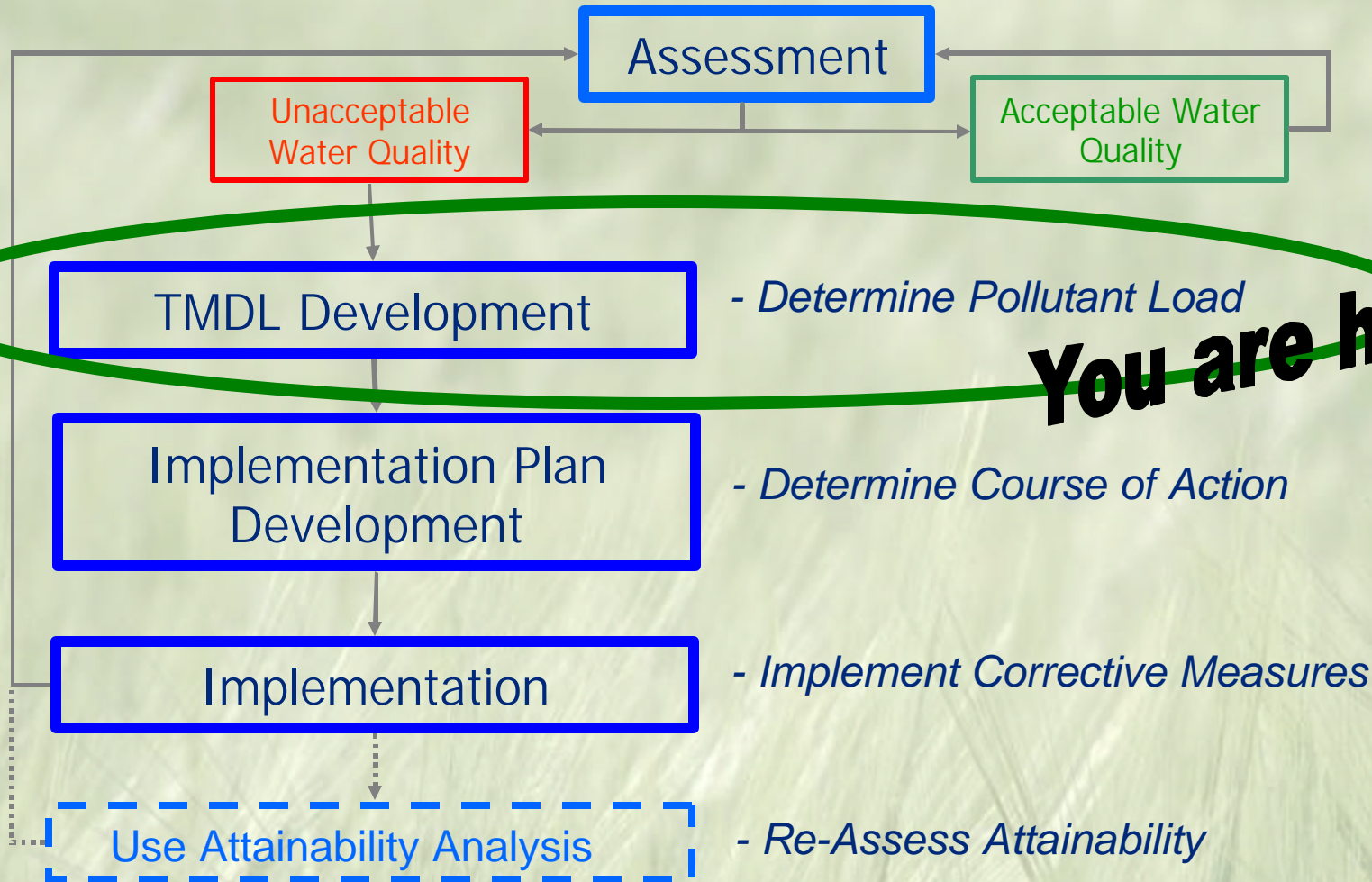
December 2, 2009



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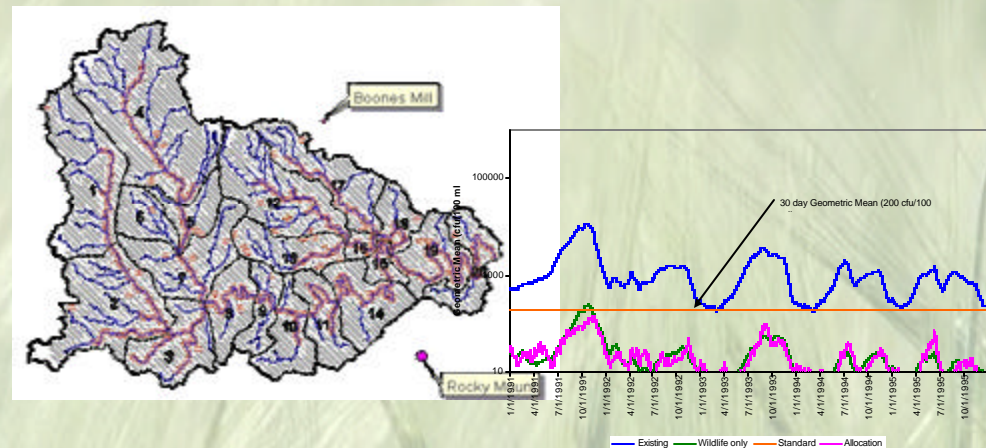
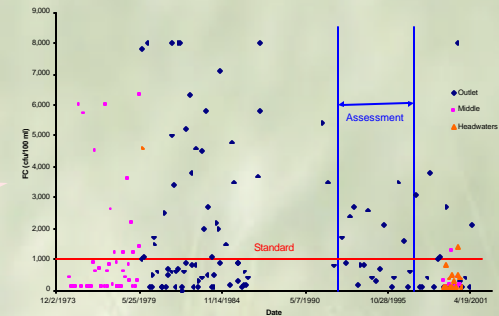
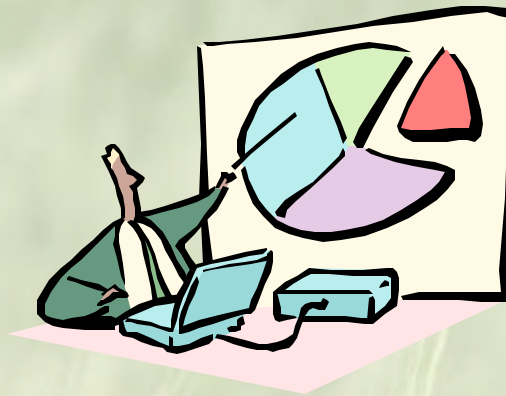
Natural Resource Solutions
Through Science and Engineering

TMDL Process

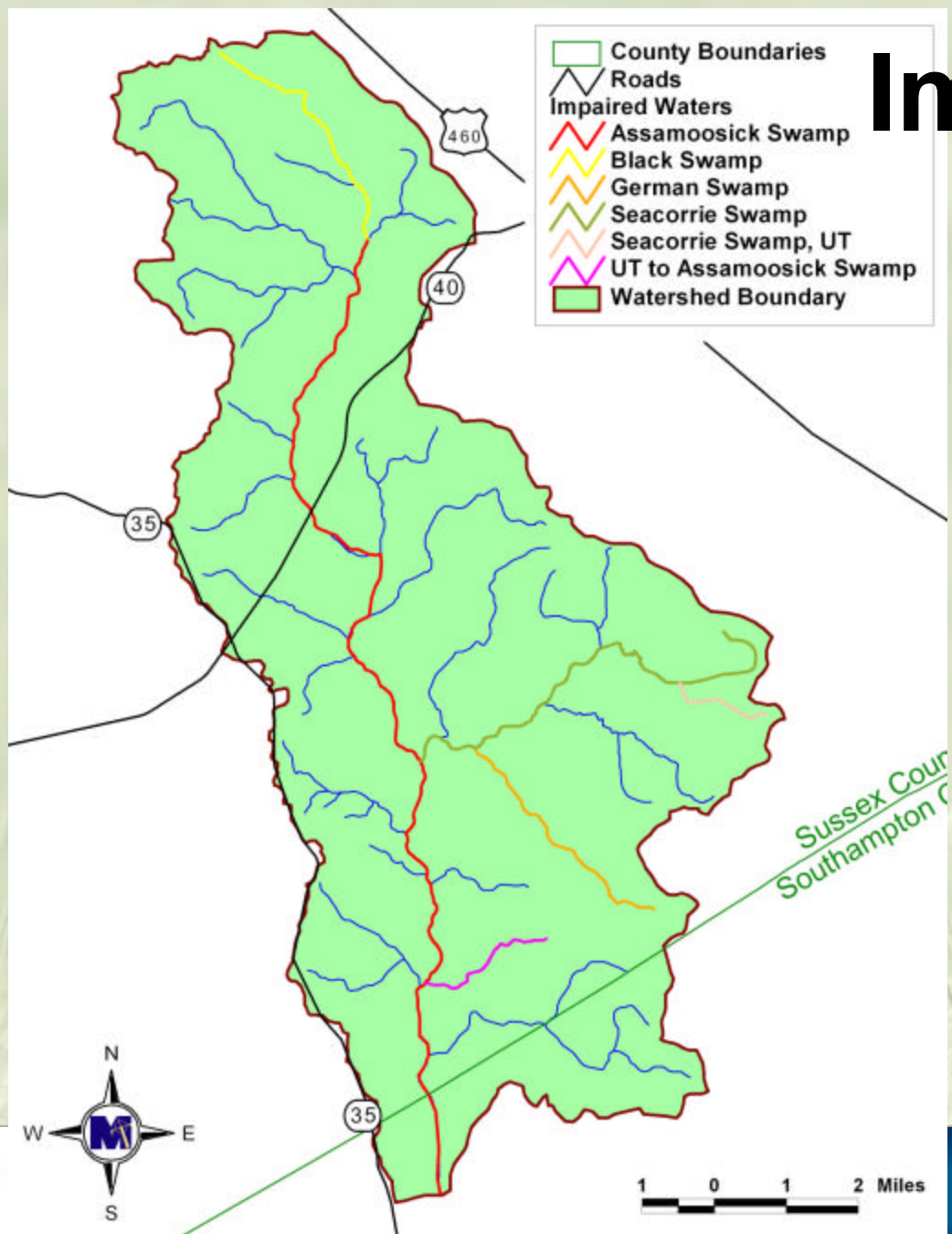


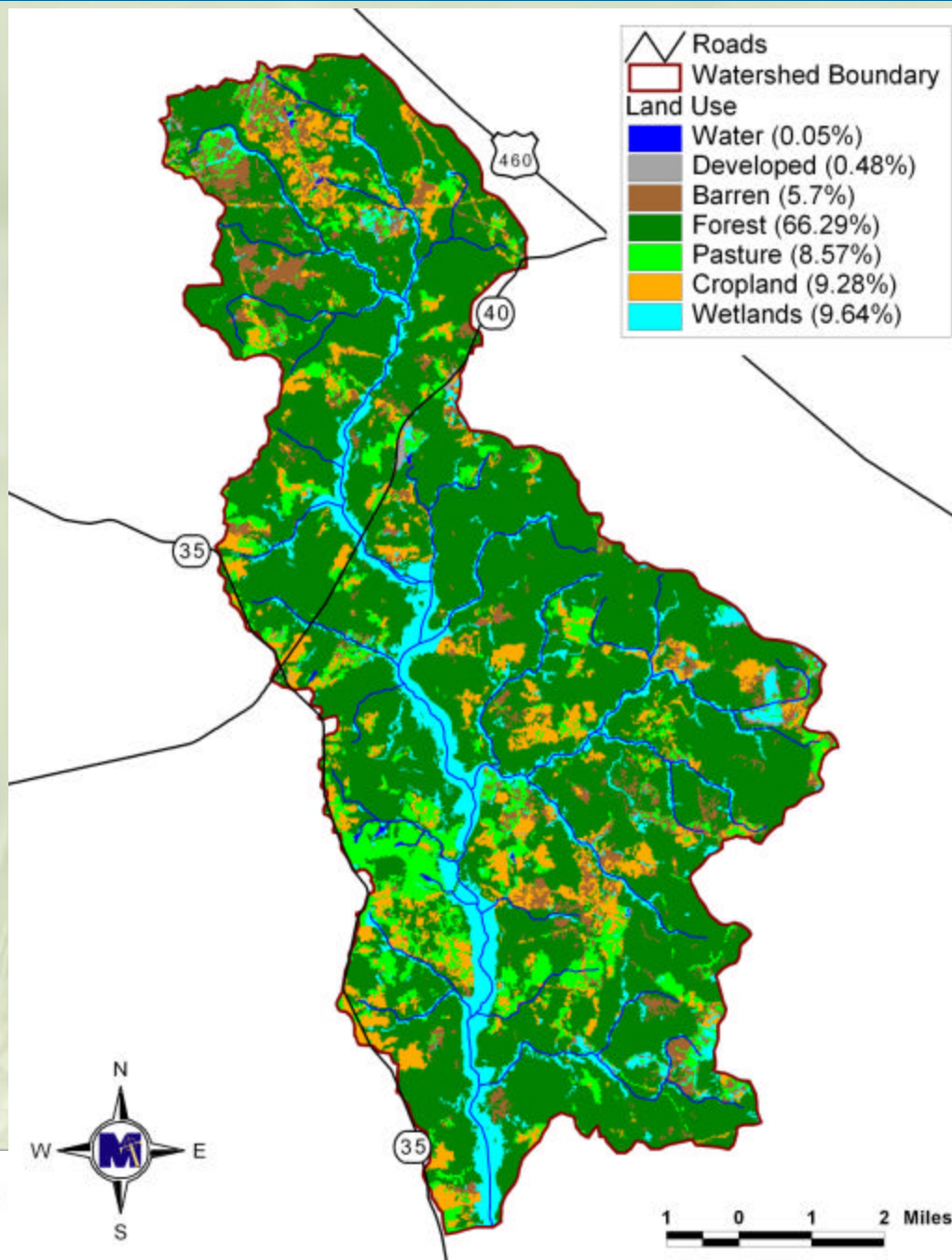
Major Components of the TMDL Report Development

- Source Assessment
- Modeling
 - Hydrology
 - Water Quality
 - Load Allocation
- Public Participation



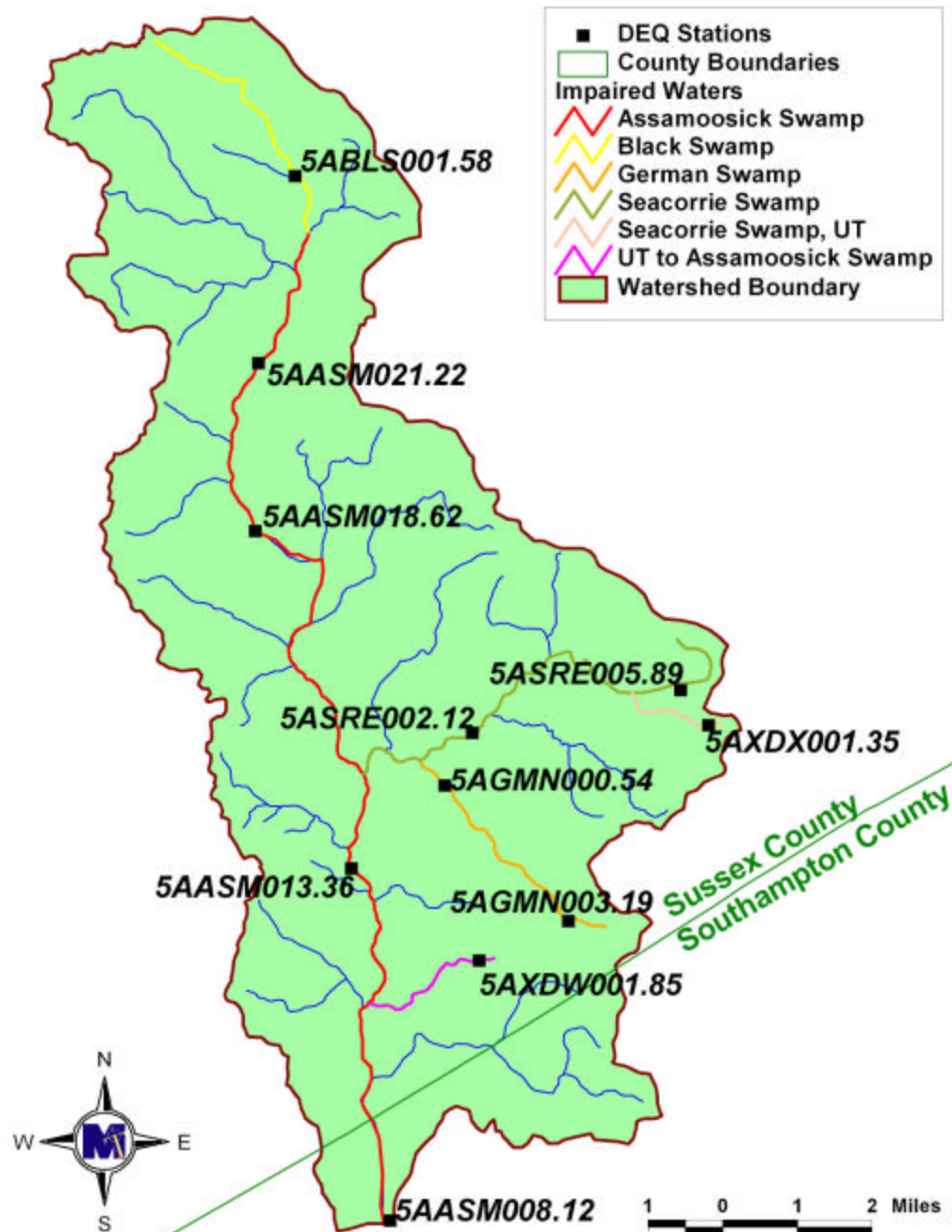
Impairments





Watershed Land Use

DEQ Stations



MapTech

DEQ *E. coli* Data

Stream	Station	Date	Count	Minimum	Maximum	Mean	Violation %
Assamoosick Swamp	5AASM008.12	1/07 - 12/07	8	24	200	93	0.0%
Assamoosick Swamp	5AASM013.36	1/07 - 12/07	12	9	396	122	16.7%
Assamoosick Swamp	5AASM018.62	1/07 - 12/07	12	20	270	82	8.3%
Assamoosick Swamp	5AASM021.22	1/07 - 12/07	24	22	920	150	8.3%
UT Assamoosick Swamp	5AXDW001.85	6/04 - 9/07	8	1	800	268	37.5%
Black Swamp	5ABLS001.58	1/07 - 12/07	12	16	1,205	241	33.3%
Deep Branch	5ADEP001.73	1/07 - 12/07	12	4	100	32	0.0%
German Swamp	5AGMN000.54	1/07 - 12/07	9	43	216	88	0.0%
German Swamp	5AGMN003.19	6/04 - 12/07	12	1	800	113	8.3%
Ivy Branch	5AIVY001.00	1/07 - 12/07	12	1	170	41	0.0%
Seacorrie Swamp	5ASRE002.12	1/07 - 12/07	21	6	1,200	186	19.0%
Seacorrie Swamp	5ASRE005.89	6/04 - 12/07	12	2	950	246	25.0%
UT Seacorrie Swamp	5AXDX001.35	6/04 - 5/07	6	50	1,430	568	50.0%



Bacterial Source Assessment

- Permitted discharges

- Wastewater treatment facilities
- Other Permitted Discharges

- Human

- Biosolids
- Failed Septic Systems
- Straight Pipes

- Pets

- Livestock

- Wildlife

[Human + Pet + Livestock =
Controllable Loading]



Permits in the Study Area (2009)

- 1 Permitted Discharge permitted for control of fecal bacteria
- 4 Hog Confined Animal Feeding Operations (CAFOs)

Human Source

Population, housing units, and onsite treatment system based on U.S. Census

- Failing or Improperly Functioning Septic Systems
 - Effluent reaching ground surface throughout the year
 - Lateral movement continuously to stream
- Straight Pipes
 - Direct continuous input into stream
- Biosolids
 - Land-applied



Human Population (2009)

Impairment	Population	Housing Units	Housing Units with Sewer	Housing Units with Septic	Housing Units with "Other"	Housing Units with Failing Septics
Black Swamp	30	11	10	1	0	1
German Swamp	16	8	0	8	1	1
Seacorrie Swamp	23	10	0	7	2	2
UT Seacorrie Swamp	2	1	0	0	0	0
Assamoosick Swamp	1,152	251	81	148	22	33
UT Assamoosick Swamp	0	0	0	0	0	0
Project Watershed Total	1,152	251	81	148	22	33



Pet Source (2009)

- Population/household based on literature values, veterinarians, and animal control
- Translated to housing units based on U.S. Census
- Land-applied

Pet Populations (2009)

Impairment	Dog	Cat
Black Swamp	5	6
German Swamp	4	4
Seacorrie Swamp	5	5
UT Seacorrie Swamp	0	0
Assamoosick Swamp	116	130
UT Assamoosick Swamp	0	0
Project Watershed Total	116	130

Livestock Source

- Population
 - Virginia Agricultural Statistics
- Distribution of waste
 - Pastured
 - Confined, waste collected, spread
 - Direct deposition to the stream
- Seasonal varying applications

Livestock Populations (2009)

Impairment	Beef Stockers	Beef Calves	Dairy	Horse	Sheep	Hog
Black Swamp	5	5	0	0	0	0
German Swamp	4	4	0	0	0	10,999
Seacorrie Swamp	16	16	0	0	0	0
UT Seacorrie Swamp	2	2	0	0	0	0
Assamoosick Swamp	117	117	0	0	0	21,998
UT Assamoosick Swamp	7	7	0	0	0	0
Project Watershed Total	117	117	0	0	0	21,998



Wildlife Source

- Population
 - Animal densities from VDGIF biologists
 - Habitat from literature values
- Distribution of waste based on habitat
 - Land-applied
 - Direct deposition to the stream
- Seasonal variations based on migration patterns and food sources



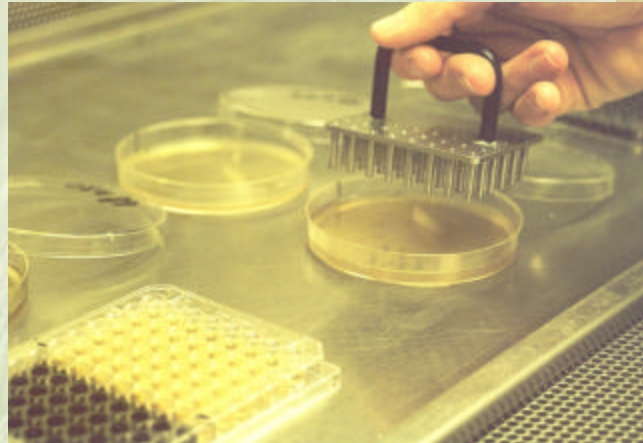
Wildlife Populations

Impairment	Deer	Turkey	Beaver	Raccoon	Muskrat	Duck	Goose
Black Swamp	273	72	88	591	114	2	1
German Swamp	410	108	117	875	71	1	1
Seacorrie Swamp	715	187	200	1,561	328	7	3
UT Seacorrie Swamp	635	166	176	1,381	22	0	0
Assamoosick Swamp	1,529	401	439	3,314	1,688	35	17
UT Assamoosick Swamp	85	22	18	187	33	1	0
Project Watershed Total	1,529	401	439	3,314	1,688	35	17



Bacterial Source Tracking

- Antibiotic Resistance Analysis (ARA)
 - Differentiates the sources of bacteria based on bacterial resistance to antibiotics



Bacterial Source Tracking Results

Stream	Station ID	Wildlife	Human	Livestock	Pet	Anthropogenic
Assamoosick Swamp	5AASM013.36	46%	6%	15%	33%	54%
Assamoosick Swamp	5AASM018.62	55%	4%	12%	29%	45%
Assamoosick Swamp	5AASM021.22	36%	12%	25%	27%	64%
Seacorrie Swamp	5ASRE005.89	45%	16%	11%	28%	55%
UT to Seacorrie Swamp	5AXDX001.35	34%	15%	7%	44%	66%
German Swamp	5AGMN000.54	56%	11%	22%	11%	44%
Black Swamp	5ABLS001.58	26%	16%	48%	10%	74%

Anthropogenic = Human + Livestock + Pet = Controllable Loading



How do we determine the TMDLs?



+

Watershed data



TMDL

Hydrologic Modeling Components

- Climatic data
- Land use
- Topography
- Soils
- Stream channel characteristics
- Point source discharge/withdrawal
- Flow data



Water Quality Modeling Components

- Sources
 - Fecal production
 - FC densities
 - FC distribution
- Delivery Mechanisms
 - Direct
 - Land-applied
- Temporal Variation



Modeling





- Public Meeting 2 (early winter 2010)
- Public Review
- Submit to EPA
- State Approval
- Implementation Plan Development
- Implementation



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Send written comments by
January 4th